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CYANIDATION OF TWO SAMPLES OF GOLD ORE FROM CAMFLO MATTAGAMI MINES LIMITED, MALARTIC, QUEBEC

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by

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MINERAL PROCESSING DIVISION

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CYANIDATION OF TWO SAMPLES OF GOLD ORE FROM CAMFLO MATTAGAMI MINES LIMITED, MALARTIC, QUEBEC

by

A. Stemerowicz*

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SUMMARY OF RESULTS

Gold recoveries in the 93-95% range can be obtained by straight cyanidation of the ores using the solution strength employed in the Canadian Malartic Gold Mines Limited mill, viz. sodium cyanide - 0.75 lb/ton solution, lime - 0.90 lb/ton solution. Gold recoveries obtained for the different ore types are given below along with pertinent test data:

Ore Type	Grind % -200 M	Contact Time Hours	% Au Recovered in Preg. Sol'n
Diorite	98.8	24	93.50
Porphyry	97.5	24	94.12
Composite - 17% Diorite - 83% Porphyry	69.3	44	93.67
" " "	97.6	48	95.57

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INTRODUCTION

Location of Property

The samples were said to be from the Camflo Mattagami Mines Limited gold prospect consisting of twelve claims in Malartic and Fourniere Townships, Malartic area of northwestern Quebec.

Shipment

The ore samples which were received on January 16, 1964 consisted of 1 bag containing 27 lb of low sulphide porphyry ore and 1 bag which contained 19 lb of high sulphide diorite ore. Both samples were in the form of diamond drill core rejects approximately 1/4 inch in size. The samples were submitted by Mr. B.K. Meikle, Chief Geologist, Camflo Mattagami Mines Limited, Box 640, Malartic, Quebec.

Nature of Investigation Requested

The main purpose of the investigation, as outlined by Mr. Meikle, was to determine whether the ores could be successfully custom treated by cyanidation at either the Canadian Malartic Gold Mines Limited or Malartic Goldfields Limited mills. Mr. Meikle also wished to determine whether it would be advantageous to mill the ores separately as against milling a composite ore made up to conform to the projected mining rate of 17% diorite ore and 83% porphyry ore.

Cyanide Practice at the Canadian Malartic and Malartic Goldfields Mills

Canadian Malartic

The ore is ground in cyanide solution to 70% -200 mesh and cyanided in agitators for 20 hours.

Malartic Goldfields

The ore is ground in cyanide solution in three closed circuit stages. The secondary classifier overflow is further classified in an 8 in. cyclone--cyclone overflow goes to the cyanide circuit while cyclone sands are reground to 75% -200 mesh in closed circuit with a 6 in. cyclone before being sent to the cyanide circuit. A small agitator is incorporated in the regrind circuit so that the reground cyclone sands are partially cyanided before going to the main cyanide circuit giving a total contact time of about 24 hours.

Solution strengths employed at the two mills are as follows:

	Canadian Malartic	Malartic Goldfields
lb/ton solution		
Sodium cyanide	0.75	0.44
Lime	0.90	0.30

Milling data quoted above for the two mills was supplied by Messrs. D.R. Beaumont and H.W. Hughes, mill superintendents at Canadian Malartic and Malartic Goldfields respectively.

Sampling and Analysis

After selecting specimens for mineralogical examination each ore sample was crushed to -10 mesh and split into a number of equal portions on a Jones Riffler. One of the portions from each sample was selected at random as a head sample while the remaining portions were set aside for test work.

Head Sample Analysis*

		Diorite Ore	Porphyry Ore
Gold (Au)	- oz/ton	0.20	0.34
Silver (Ag)	- "	0.03	0.025
Iron (Sol Fe)	- %	7.74	1.41
Sulphur (S)	- %	5.03	0.59

Semi-Quantitative Spectrographic Analysis**

	Elements	
Range - %	Diorite Ore	Porphyry Ore
Principal constituent	Ca, Fe, Si, Na	Si
10.0 to 1.0	Al, Mg	Al, Mg, Na, Sr
1.0 to 0.1	Ti, Mo, Zr, Cu, V	Ca, Fe
0.1 to 0.01	Mn	Mn, Zr, Ti
0.01 to 0.001	-	Cu, Cr
<0.001	-	Ni, Ga

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* From Internal Report MS-AC-64-317

** From Internal Report MS-AC-64-65

MINERALOGICAL EXAMINATION*

The selected ore specimens and a portion of each head sample were sent to the Mineral Sciences Division for mineralogical examination. Polished sections were prepared from head sample gravity concentrates obtained from each ore type by heavy liquid separations. A list of metallic and gangue minerals identified in the polished sections is given below:

Diorite Ore	Porphyry Ore
Metallic Minerals	Metallic Minerals
Pyrite	Pyrite
Arsenopyrite	Arsenopyrite
Sphalerite	Sphalerite
Chalcopyrite	Chalcopyrite
Galena	Magnetite
Pyrrhotite	Ilmenite
Magnetite	Native Gold
Ilmenite	Petzite - $(Ag, Au)_2Te$
Native Gold	
Native Silver	Gangue Minerals
Gangue Minerals	Quartz
Quartz	Feldspar
Feldspar	Chlorite
Chlorite	Biotite
A carbonate	Amphibole
	A carbonate
	Periclase

In the diorite ore the native gold was found attached to larger pyrite and sphalerite grains, while in the porphyry ore the native gold occurred as minute inclusions in pyrite. The presence of petzite in the porphyry ore was inferred from optical properties. The two grains suspected of being petzite were too small for positive identification.

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*From Internal Report MS-AC-64-8

INVESTIGATION PROCEDURE

A total of 22 batch cyanidation tests were carried out on samples of diorite and porphyry ores and on a composite composed of 83% porphyry ore and 17% diorite ore. The fineness of grind was varied from approximately 70% to 99% -200 mesh. In most of the tests a contact time of 24 hours was used but a few tests were tried using contact times of 36 and 48 hours. Tests were done in sets of two--for each combination of grind and contact time one test was done using the Canadian Malartic solution strength while the other was done using the Malartic Goldfields solution strength.

A grind of about 70% -200 mesh and a contact time of 24 hours was assumed to approximate conditions in both the Malartic Goldfields and Canadian Malartic mills.

DETAILS OF INVESTIGATION

500 gram samples of -10 mesh ore were ground in an Abbe porcelain mill with steel balls at a pulp dilution of 57% solids and for periods ranging from 9 to 30 minutes. The ground samples were then cyanided for the required time at a water-solids ratio of 2:1.

Test data and results are shown in Tables 1 and 2 which follow.

TABLE 1

Cyanidation Tests using Malartic Goldfields Solution Strength

Sodium cyanide - 0.44 lb/ton solution
Lime - 0.30 " "

Test No.	Ore	Grind		Contact Time - hrs	Cyanide Residue Au - oz/ton*	% Au Recovered** in Preg Sol'n	Reagent Consumption - lb/ton ore	
		Time min	% -200 M				NaCN	Lime
1	Diorite	9	71.5	24	0.027	86.50	0.36	1.28
2	"	12	83.2	24	0.027	86.50	0.36	1.32
3	"	20	94.0	24	0.017	91.50	0.36	1.72
4	"	30	98.8	24	0.018	91.00	0.72	1.84
5	Porphyry	12	73.4	24	0.040	88.24	0.20	1.00
6	"	20	90.6	24	0.057	83.24	0.20	1.12
7	"	30	97.5	24	0.033	90.29	0.20	1.24
8	Composite	11	70.9	24	0.083	73.73	0.20	0.92
9	"	11	69.3	36	0.040	87.34	0.20	1.32
10	"	11	69.3	48	0.040	87.34	0.20	1.04
11	"	30	97.6	48	0.032	89.87	0.48	1.28

TABLE 2

Cyanidation Tests using Canadian Malartic Solution Strength

Sodium cyanide - 0.75 lb/ton solution
Lime - 0.90 " "

Test No.	Ore	Grind		Contact Time - hrs	Cyanide Residue Au - oz/ton*	% Au Recovered** in Preg Sol'n	Reagent Consumption - lb/ton ore	
		Time min	% -200 M				NaCN	Lime
12	Diorite	9	71.5	24	0.027	86.50	0.40	1.60
13	"	12	83.2	24	0.022	89.00	0.40	2.40
14	"	20	94.0	24	0.020	90.00	0.52	2.80
15	"	30	98.8	24	0.013	93.50	0.72	3.08
16	Porphyry	12	73.4	24	0.035	89.71	0.24	2.20
17	"	20	90.6	24	0.025	92.65	0.28	2.56
18	"	30	97.5	24	0.020	94.12	0.32	2.88
19	Composite	11	70.9	24	0.045	85.76	0.20	2.20
20	"	11	69.3	36	0.025	92.09	0.08	2.52
21	"	11	69.3	44	0.020	93.67	0.28	2.56
22	"	30	97.6	48	0.014	95.57	0.32	3.00

* From Internal Reports MS-AC-64-317, 368, 479

** Gold recoveries calculated by difference. For the composite ore a head assay of 0.316 oz Au/ton was used--this value was obtained by taking a weighted average of the assays of the diorite and porphyry ores.

CONCLUSIONS

(1) The higher cyanide strength used at Canadian Malartic gives higher gold recoveries.

(2) A finer grind or a longer contact time than that used at either Canadian Malartic or Malartic Goldfields is required to give satisfactory gold recoveries by straight cyanidation. The highest recovery (Test 22) on composite ore was obtained at a fine grind of 97.6% -200 mesh and contact time of 48 hours. Not enough ore was available to try a combination of fine grinding and long contact time on the individual ore types but from the trend of results obtained in other tests it can be assumed that the gold recovery would be as good as or better than that obtained for the composite ore.

(3) At a grind of approximately 70% -200 mesh and contact time of 24 hours, the inclusion of the diorite ore with the porphyry to make up the composite had an adverse effect on gold recovery especially when using the lower Malartic Goldfields cyanide strength (compare Tests 1 and 5 with Test 8 and Tests 12 and 16 with Test 19). When using the Canadian Malartic cyanide strength, but with finer grinding and longer contact time, the differences obtained in recoveries between the individual ores and the composite ore would probably not be of economic significance.

Because gold is associated with sulphides in both ores, the floating of a bulk sulphide concentrate with subsequent regrinding of the concentrate followed by cyanidation might be a more efficient and lower cost treatment method than straight cyanidation.

The presence of petzite, a refractory gold-silver telluride was indicated in one of the samples during mineralogical examination. This mineral has a very slow dissolution rate in cyanidation and may account for the fact that higher gold recoveries were obtained during the longer contact time. Further investigation on a larger sample of ore would be necessary to solve this problem.

More ore was requested to investigate flotation or other possible methods of processing this ore but since none was received the investigation was terminated.

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